

## **Application of a dynamically-consistent global ocean data assimilation system to study upper-ocean heat budget**

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An ocean data assimilation system is developed to synthesize satellite and in-situ observations with a near-global ocean general circulation model. The goal is to describe and understand variability of ocean circulation and its relation to climate. The backbone of the data include sea level measurements obtained from the TOPEX/Poseidon and JASON-1 altimeters as well as temperature profiles and moorings. The data are assimilated through a hierarchy of advanced assimilation methods. The analyses are characterized by physical consistency in the evolution of estimated oceanic state. In particular, heat, salt, and volume conservations are satisfied. Such physical consistency permits the analysis of various processes in controlling temporal evolution of the oceanic state. Examples of scientific applications are given, focusing on upper-ocean heat budget of various climate events in the past decade such as El Nino-Southern Oscillation, Indian-Ocean Dipole, and phase-switch of Pacific Decadal Oscillation. The relative contribution of advection, mixing, and surface heat flux are evaluated. Similarities and differences in heat budget associated with various climate events are highlighted. The effort is part of the consortium "Estimating the Circulation and Climate of the Ocean (ECCO)". Assimilation products are regularly updated and are available via a Live Access Server at <http://www.ecco-group.org/las>.